

THE LIFE HISTORY OF *METAMIMAS AUSTRALASIAE* (DONOVAN) (LEPIDOPTERA: SPHINGIDAE)

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Abstract

The life history of the hawk moth *Metamimas australasiae* (Donovan) is described and figured and observations on biology and behaviour are recorded.

Introduction

The hawk moth *Metamimas australasiae* is one of Australia's largest hawk moths, occurring from Cairns to southern coastal New South Wales (Common 1990). Larvae have been recorded previously feeding on two species of *Eucalyptus*, *E. elata* and *E. saligna* (Moulds 1984).

On 7.ii.1993, I was given a live female *M. australasiae* in a small cardboard box. Between its capture the previous night and delivery to me it laid 12 eggs. The following description of the life history and adult behaviour are based on larvae and adults reared from these eggs.

Methods

The eggs were removed from the cardboard on which they were laid and placed in a covered petri dish. Upon hatching the larvae were supplied with young shoots of *Eucalyptus tereticornis*, a food plant previously unrecorded for *M. australasiae*. As the larvae grew, older foliage was supplied.

The larvae were housed in a rectangular plastic container, 135 mm x 130 mm x 330 mm high. Cuttings were placed in a small bottle of water standing on the base of the container and were replaced as necessary to maintain a fresh food supply. From the beginning of the third instar, larvae were housed in a larger cage, 540 mm x 450 mm x 760 mm high, with perspex on three sides, a wooden base and gauze on one side and the top. Pupation took place in one of two rectangular plastic containers, 330 mm x 135 mm x 130 mm high, in which soil, bark chips and dead leaves were provided. One of the containers had a clear PVC base to allow the structure of the shelter to be observed. As each larva began searching for a pupation site it was transferred to one of these containers. Every few days the substrate in which the larvae had pupated was lightly misted with water.

Life History

Egg: Diameter 3 mm; spherical but with a very slightly flattened base. Green when first laid but after 11 days developed a reddish brown band roughly 0.5 mm wide which, on most, completely encircled the egg approximately 0.6 mm down from the upper surface. Seventeen days after the eggs were laid the green colour changed to a pale whitish green. The eggs hatched 22-23 days after oviposition.

First instar: Length 12 mm. Head green, produced anteriorly to a fine bifid point, apically tinged with red; apical three segments of thoracic legs tinged with red; thorax and abdomen green with a dorsolateral yellow stripe and a number of faint yellow oblique lateral stripes; numerous tiny yellow protuberances on most of body giving it a roughened appearance; posterior tip of anal prolegs tinged with red.

Second instar (Fig. 1): Length 28 mm. Head mostly green, covered with numerous tiny yellow protuberances, strongly produced to a fine bifid point, apically tinged reddish brown, yellowish towards base; apical three segments of thoracic legs tinged with red; thorax and abdomen green with a dorsolateral yellow stripe, much fainter on the mid abdominal segments; numerous tiny yellow protuberances on most of body giving a roughened appearance; yellow oblique lateral stripes slightly darker than first instar.

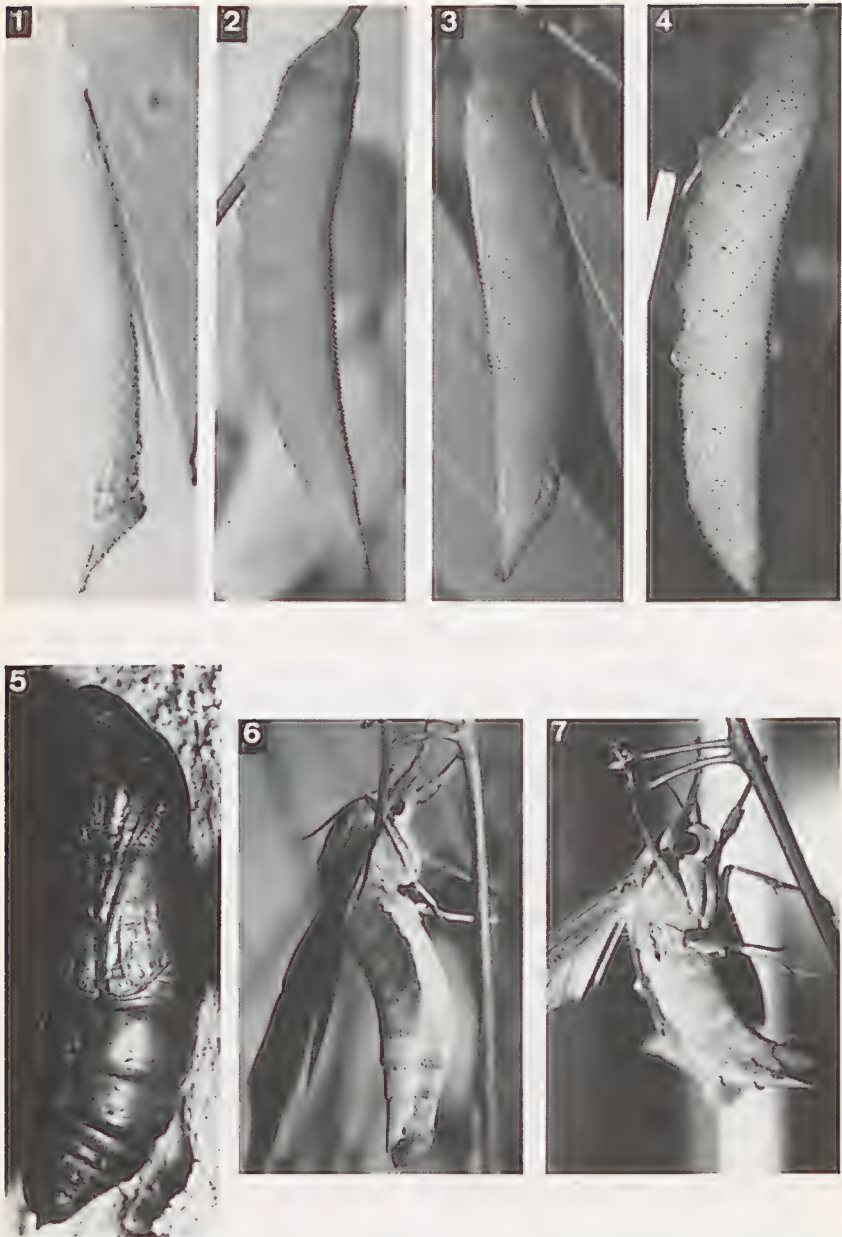
Third instar (Fig. 2): Length 48 mm. Head green, covered with numerous tiny yellow protuberances, strongly produced to a fine bifid point, apically tinged reddish brown; apical three segments of thoracic legs tinged with red; thorax and abdomen green with a dorsolateral yellow stripe on thorax and first three abdominal segments; abdomen with six yellow oblique lateral stripes, the most posterior very distinct.

Fourth instar (Fig. 3): Length 65 mm. As in earlier instars, but yellow dorsolateral stripe running from near red bifid tip of head to the second abdominal segment; abdomen with six yellow oblique lateral stripes, the most posterior very distinct.

Fifth instar (Fig. 4): Length 117 mm. Head bluish green, reduced to a slightly bifid, blunt conical shape; thorax and abdomen bluish green, slightly greener on the last few abdominal segments; the posterior oblique lateral stripe very distinctly yellow, with a small purplish, irregularly shaped blotch just above it and near its dorsal end; tiny yellow protuberances on body conspicuous, giving larva a very roughened appearance.

Pre-pupal larva: As fifth instar but most of the green dorsal and dorsolateral areas of thorax and abdomen brownish green; tiny yellow protuberances unchanged.

Pupa (Fig. 5): Length 68 mm. Stout, shiny, dark brown, almost black; head and thorax fairly smooth, antennae reaching to about two-thirds length of fore wings, labial palpi and fore femora not exposed; proboscis and mesothoracic tarsi reaching to anterior margin of abdominal segment 4, fore wings to posterior margin of segment 4; abdominal segments with numerous fine transverse grooves and narrow anterior bands of punctures, segments 5 and 6 moveable, with small ventral depressions representing ventral prolegs of larva; cremaster short, deeply grooved, tapering, apically acute.



Figs 1-7. Larvae, pupa and adults of *Metamimas australasiae*: (1) Second instar larva; (2) Third instar larva; (3) Fourth instar larva; (4) Fifth instar larva; (5) Pupa; (6) Adult male at rest; (7) Adult male in defensive posture.

Behaviour

Larvae: All instars rested with their pointed heads directed anteriorly. During development they fed singly. Third and later instars twitched or slightly jerked their heads dorsally when approached or disturbed; this action continued for some minutes after the initial stimulus and nearby larvae often behaved similarly. When at rest, third and later instars rested in a head downward position, usually only grasping the support by the anal claspers and the ventral prolegs of abdominal segment 6. Just prior to pupation the larvae exhibited another remarkable behaviour, for which I have not been able to ascertain a function. This involved coating much of the body with a clear, somewhat viscous liquid from the mouth. The liquid glistened on the sides of the larvae and often contained small bubbles. Following this action the larvae rested for a period of two to three hours, by which time their colour changed to that of the pre-pupal stage, before searching for a suitable pupation site. The larval stage lasted for an average of 345 days, including a pre-pupal resting stage of 6 days after the pupal cell had been constructed. Although the five larvae reared to maturity all came from the same batch of eggs, hatched within 24 hours of each other and were reared under the same conditions, there was a variation of up to three weeks in the duration of the third and subsequent instars.

Pupa: Pupation took place in a shelter constructed of soil particles and leaf and bark litter combined with silk. Shelters measured approximately 78 mm long, 38 mm wide, 23 mm high and were irregularly oval in shape. Newly formed pupae were mostly green with some brownish areas on the ventral surface. After about 24 hours the colour changed to very dark shiny brown, almost black. The average pupal duration for larvae which pupated in February was 37 days.

Adult: Males of *M. australasiae* possess an expandable hair-pencil (Fig. 7) on each side near the base of the abdomen. By dissecting the abdomen I found that each pencil was enclosed in a pocket formed by a fold in the pleural membrane on abdominal segments 2 and 3. The base of the hair-pencil was attached to the pleural membrane of segment 2 directly ventral to the second abdominal spiracle. The dorsal margin of sternite 2 in the vicinity of the pocket and the entire dorsal margin of sternite 3 was heavily sclerotised. The pockets in the pleural membranes and the hair-pencils have not been recorded in any other species of Sphingidae. At rest (Fig. 6) adults hung from a branch and the tip of the abdomen was curved dorsally, the rest of the abdomen held ventrally and the head depressed. In this resting posture the hair-pencils were retracted. When the adult was disturbed, by gently bumping the branch on which it was resting or by touching it, the tip of the abdomen was thrust ventrally and the valvae were opened widely to expose the black inner area, which made the surrounding orange area appear more prominent. Simultaneously, the hair-pencils on the abdomen were expanded (Fig. 7);

when expanded the array of hairs measured 11 mm in diameter. This posture was held from a few to 20 seconds before the resting position was resumed. The function of the hair-pencils was not ascertained. Females exhibited a similar defensive behaviour but were without the expandable hair-pencils. Newly emerged adults of *M. australasiae* also squirted one or several 'bursts' of meconium from the anus when in the defensive position. This occurred almost every time that the defensive posture was adopted. The fluid was squirted distances of up to 15 cm and occurred up to 24 hours after eclosion, the maximum period that any of the reared specimens was kept alive. The two reared females were 15 & 30 mm smaller in wingspan than the parent female. As ample fresh food was supplied at all times during the larval development it is possible that the species of *Eucalyptus* used may have had unsuitable nutrient levels or that the cuttings, although kept as fresh as possible, were not sufficiently nutritious to permit maximum growth.

Discussion

The mature larva of *M. australasiae* is similar to that of *Coequosa triangularis* (Donovan). Both lack the caudal spine which is present in the larva of most Australian sphingids. The shining black, eye-like spot present on the anal clasper of the larva of *C. triangularis* is absent in *M. australasiae* and the yellow protuberances which give the larvae of both species a roughened appearance are much shorter in *M. australasiae* than in *C. triangularis*.

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